HYDROGEN ELASTICITY PHENOMENON AND RELATED DIFFUSIVE AND MECHANICAL PECULIAR FEATURES OF HYDROGEN–METALS SYSTEMS BEHAVIOUR

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Hydrogen dissolved in a solid causes a great dilatation of a crystal lattice. Respectively, any of its nonhomogeneities and rearrangements, or any concentration gradients causes by external or internal reasons results in an appearance of "hydrogen" internal mechanical stresses. These stresses causes a new hydrogen diffusive rearrangement. Thus, a solid's crystal subsystem and hydrogen subsystem interconditionally and synergetically react upon any changes of external and internal factors. This results in an entire spectrum of diffusive and mechanical phenomena in hydrogen isotopes–metals systems, which are of great importance for fusion materials and technologies [1,2].

When hydrogen stresses are above a yield limit there is internal plastic deformation of material. So, hydrogen phase naklep (cold work) phenomenon takes place here [3,4].

When hydrogen stresses are below yield limit there is hydrogen elasticity (HE) phenomenon. The theory of HE-phenomenon [5,6] gives a set of two interconnected equations, which can be solved, in general, numerically by computer only.

HE-phenomenon manifistates itself in an entire spectrum of effects.

Hydrogen diffusive effects: slow down of Fick diffusion, up-hill diffusion, thermo(pressure)–diffusive–elastic equilibrium between transforming phases, between outer hydrogen (plasma) medium and hydrogen-containing materials.

HE-mechanical effects: reversible and non-reversible micro- and meso-reconstructions of metal surface, form-changes of articles (macro effects) and so on.

In the report there will be given a theoretical analysis of HE influence on hydrogen diffusion and demonstrated the original results of *in situ* investigations and video registration of HE-mechanical effects.

References

1. V.A. Goltsov, A.F. Volkov et al., In: *5th All-Union Conference on Engineering Problems of Fusion Reactors* (Leningrad, October 10–12, 1990), Book of Abstracts, Moscow, 1990, p. 276 (in Russian).
2. V.A. Goltsov, *Int. J. Hydrogen Energy*, ***24*** (1999) 793.
3. V.A. Goltsov, *Mater. Sci. & Eng.*, ***49*** (1981) 109.
4. V.A. Goltsov, *J. Alloys & Compounds*, ***293–295*** (1999) 844.
5. V.A. Goltsov, Zh.L. Glukhova, A.L. Red'ko, *Int. J. Hydrogen Energy*, ***22*** (1997) 179.
6. L.I. Smirnov, V.A. Goltsov, *Phys. Met. & Metallography*, ***84*** (1997) 599.